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Original Article

# POINT PREVALENCE SURVEY OF ANTIMICROBIAL CONSUMPTION IN A TERTIARY CARE HOSPITAL OF NORTH EAST INDIA

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**ABSTRACT**

**Objective:** The study was conducted to quantify antimicrobial utilization and determine the patterns of antibiotic use in Indoor patients and ICUs of the hospital.

**Methods:** The Point Prevalent Survey (PPS) was conducted in a core "National Antimicrobial Consumption Network site" as a part of the National Centre for Disease Control-WHO project "Point prevalence survey of antimicrobial consumption at healthcare facilities." The study was conducted as per the "WHO Methodology for PPS on Antibiotic use in hospitals" in March, 2022. Altogether, 1396 eligible patients were admitted during the survey period, and 1109 patients were included in the survey. Data were collected using a predesigned and pretested questionnaire in separate hospital, ward and patient forms.

**Results:** The prevalence of antibiotic use during the study was 79.44%. On an average, 1.39 antibiotics were in use per patient and only a minor fraction of (1.5%) patients received definitive therapy. Parenteral route of administration (92.72%) was mostly used for administration of antibiotics. The most common indication for antibiotic use was found to be surgical prophylaxis (30.66%). There were 154 antibiotic prescriptions in the 'Not Recommended' category. Double gram negative and double anaerobic cover accounted for 25% and 8.3% respectively of the total prescriptions.

**Conclusion:** Empirical use of antibiotics is common and lack of utilisation of antimicrobial susceptibility testing services requires urgent interventions. Routine monitoring of antibiotic use is recommended to improve the current scenario of antimicrobial consumption.

**Keywords**: Point prevalence survey, Antibiotic consumption, Antimicrobial stewardship


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## INTRODUCTION

Antimicrobial Resistance (AMR) has become a global threat killing, 700,000 people per year and another 10 million are projected to die from it by 2050. India is leading the world in total consumption of antibiotics for human use, and in this regard, overutilization and inapt antibiotic use have been identified as a serious national public health threat to the increase and spread of AMR [1, 2]. Antimicrobial stewardship is of paramount importance in ameliorating the existing prescribing and dispensing patterns and optimising antibiotic use in the country to reduce antimicrobial resistance, along with lowering the risk of adverse drug events, treatment complications, and institutional costs [3-5]. The paucity of information and data about the quantity and quality of antimicrobial prescribing has been identified as a key barrier to the successful development and implementation of antimicrobial stewardship programs in the country. In this regard, Point prevalence surveys (PPS) have been endorsed as a useful and convenient approach within stewardship programs for surveillance of the quality of antimicrobial prescribing at ward and institutional levels [6]. The PPS enables data collection with minimized workload and resource requirements at a specific time point, and data from such systems can be crucial for quality improvement and subsequent interventions to tackle antimicrobial resistance [7].

The present study seeks to conduct a point prevalence survey to quantify antimicrobial utilization and determine patterns of antibiotic use in a tertiary care hospital in Assam as part of the Point Prevalence Survey of antimicrobial consumption by NCDC (National Centre for Disease Control under the NAC-NET (National Antimicrobial Consumption Network) AMR network. The study was conducted to gather information that might serve as a baseline for future point-prevalence surveys, and play a crucial role in the establishment and measuring the effect of Antimicrobial stewardship program in the hospital. It will be helpful in optimizing the use of antimicrobials in human health as outlined in the National action plan on AMR containment in the country. The primary objective of this survey was to find the point prevalence of antibiotic prescribing in Indoor patients and ICUs. The secondary objective was to collect information on the rates of prescribing of antibiotics by substance name; by indication and category of patient; and by specialty of healthcare facility.

## MATERIALS AND METHODS

### Study design and setting

A hospital based cross-sectional study was conducted using a predesigned and Pretested Point Prevalence Survey (PPS) questionnaire in the indoor and ICU patients of all the departments of the selected healthcare facility. Therefore, the data collection was carried out over a period of 3 (three) days i. e., 7th, 8th and 9th March 2022.

### Study population

All inpatients admitted in the wards and ICUs of the tertiary care hospital and those on the day of the study prior to 9:00 am were considered for the study according to the WHO protocol for point-prevalence studies [8].

### Inclusion and exclusion criteria

All inpatients admitted in the ward *prior to* 9:00 am and who were receiving at least one antibiotic as treatment or prophylaxis on the day of the survey was included in the study. Data were collected using two forms, one for ward-level data and another for patient-level data, which was consistent with the Global-PPS method [9]. All

patients admitted after 9:00 am on the day of the survey and all patients for daycare admissions such as endoscopy or outpatient dialysis patients, etc., were excluded from the study. Data were also not collected from patients discharged before 9:00 am [10].

**Sampling technique**

Altogether, 1396 eligible patients were admitted during the survey period, and 1109 patients were included in the survey following WHO PPS methodology. A total number of 287 patients were excluded from the survey based on exclusion criteria.

**Data collection and analysis**

A comprehensive training on the protocol for PPS for surveyors involving doctors, pharmacists and nurses in presence of Central Coordinator, NCDC, India was conducted prior to data collection. Data collection took place in the month of March 2022. The training sessions included practising with and pilot testing the data collection forms and methods. The teams abstracted data from patient medical records, treatment sheets and nurses' notes. Only antibiotics administered by routes other than topical were included in the study. Two types of data were collected from all the case sheets present. The Ward data included information about the ward in which the PPS is being undertaken, date of data collection and categorization of ward types such as adult medical ward, adult surgical ward, intensive care unit, pediatric medical ward etc. On the day of data collection, the total number of beds in the ward and the number of patients present on the ward at 9:00 am were recorded. The Patient data included information on all in-patients receiving an antibiotic prescription at 9:00 am on the day of the survey. For each patient prescribed any of the specified antimicrobials, the following types of data were recorded (1) Patient information: gender, age, weight for (children) (2) Antibiotic information: Generic substance name with dosage and route of administration, site of infection, indication of antibiotic prescribing (i. e. hospital-acquired infections, community-acquired infections and surgery or medical prophylaxis), stop/review date documented, and compliance with local treatment guidelines if any [11]. The data was anonymized. Each case sheet was given a unique number, delinking with the identity of the patient. Antibiotics were classified according to the internationally recognized WHO Anatomical Therapeutic Chemical (ATC) classification system, which classifies drugs according to their main therapeutic use and by the 2019 WHO aware (Access, Watch and Reserve) classification of antibiotics [12, 13]. Data were analyzed using SPSS version 21.

**Ethical clearance**

Ethical clearance was obtained from the Institutional Ethics Committee vide letter No. MC/190/2007/Pt-II/Dec-2021/21 dated 10-01-2022. Permission for the study has been obtained from NCDC, New Delhi. Ethical clearance was obtained from the institutional ethics committee.

**RESULTS**

The study was conducted in a tertiary care teaching hospital with 1396 inpatients that fulfilled the inclusion criteria, and 1109 inpatients out of them were found to be on antibiotics. The prevalence of antibiotic use was found to be 79.44%. Six stations in the hospital namely, medicine, surgery, obstetrics and gynaecology; paediatrics, ICU and others (ENT and orthopedics), were selected for the survey. The prevalence of antibiotic use by age group was 81.02% in adults and 18.98% in children. Out of the total patients, 52.94% were male and 47.06% were females. Table 1 summarizes the prevalence of antibiotic use per ward. Maximum antibiotic consumption was seen in the Medicine ward (31.29%). In ICUs, 14.43% of patients were under antibiotic coverage. Among the patients on antibiotics, the majority were treated with a single antibiotic (50.95%) followed by double (27.77%) and triple antibiotic (17.4%) therapy, respectively.

**Table 1: Total patients on antibiotics: ward-wise break-up**

| Wards | Eligible patients | Patients with 1 antibiotic | Patients with 2 antibiotics | Patients with ≥ 3 antibiotics | Total patients on antibiotics | Average antibiotics per eligible patient | Average antibiotics per patient on antibiotics |
|---|---|---|---|---|---|---|---|
| Medicine | 445 | 233 | 82 | 32 | 347 | 1.12 | 1.44 |
| Surgery | 345 | 157 | 87 | 36 | 280 | 1.31 | 1.61 |
| Obstetrics and Gynaecology | 216 | 50 | 33 | 96 | 179 | 1.90 | 2.29 |
| Paediatrics | 118 | 39 | 26 | 21 | 86 | 1.37 | 1.88 |
| ICUs | 175 | 64 | 56 | 40 | 160 | 1.76 | 1.92 |
| Others (ENT and Orthopaedics) | 97 | 22 | 24 | 11 | 57 | 1.08 | 1.84 |
| Total | 1396 | 565 | 308 | 236 | 1109 | 1.39 | 1.74 |

Indications for antibiotic use in surveyed wards are shown in table 2. The highest prevalence of antibiotic use was for surgical prophylaxis. Single dose antibiotic in surgical prophylaxis was used in 4 patients. 46 numbers of patients received antibiotics for surgical prophylaxis in one day and 290 patients received the same for more than one day.

**Table 2: Indication of patients on antibiotics and ward wise distribution**

| Wards | Community-acquired infection | Hospital acquired infections | Surgical prophylaxis | Medical prophylaxis | Others |
|---|---|---|---|---|---|
| Medicine | 71 | 1 | 0 | 162 | 113 |
| Surgery | 39 | 0 | 175 | 13 | 53 |
| Obstetrics and Gynaecology | 0 | 1 | 115 | 60 | 3 |
| Paediatrics | 26 | 1 | 14 | 1 | 44 |
| ICUs | 27 | 0 | 8 | 14 | 111 |
| Others (ENT and Orthopaedics) | 5 | 0 | 28 | 24 | 0 |
| Total | 168 | 3 | 340 | 274 | 324 |

The overall consumption of antimicrobials by the WHO ATC class is shown in table 3. The overall major classes of antibiotics used were Cephalosporins 763(39.39%), Penicillins 270(13.94%), Nitroimidazole (metronidazole) 258(13.32%) and Aminoglycosides 236(12.18%). The treated population received a total of 1937 antimicrobial prescriptions during the survey. The study recorded the use of an average of 1.39 antibiotics per eligible patient. The average number of antibiotics per patient on antibiotics was 1.74.

Only a minor fraction 21(1.50%) patients received definitive therapy. Double Gram-negative 349(25%) and double anaerobic 116(8.30%) coverage of antibiotic used varied across wards covered (table 4).

**Table 3: Total consumption of antibiotics by WHO ATC class**

| Antibiotics | WHO ATC code | Numbers (%) |
|---|---|---|
| Amikacin | J01GB06 | 227 (11.7%) |
| Amoxicillin | J01CA04 | 18 (0.92%) |
| Amoxicillin and Clavulanic acid | J01CR02 | 11(0.57%) |
| Ampicillin | J01CA01 | 2 (0.1%) |
| Azithromycin | J01FA10 | 38 (1.96%) |
| Aztreonam | J01DF01 | 1(0.05%) |
| Benzathine Penicillin | J01CE10 | 1 (0.05%) |
| Cefepime andTazobactum | J01RA06 | 1(0.05%) |
| Cefixime | J01DD08 | 18 (0.92%) |
| Cefoperazone | J01DD12 | 4 (0.20%) |
| Cefoperazone and Salbactum | J01DD54 | 6 (0.30%) |
| Cefotaxime | J01DD01 | 95 (4.9%) |
| Cefpodoxime | J01DD13 | 1 (0.05%) |
| Ceftazidime | J01DD02 | 2(0.1%) |
| Ceftriaxone | J01DD04 | 475(24.5%) |
| Ceftriaxone and Salbactum | J01DD63 | 145(7.48%) |
| Ceftriaxone and Tazobactum | J01DD64 | 2(0.1%) |
| Cefuroxime | J01DC02 | 14(0.72%) |
| Ciprofloxacin | J01MA02 | 6(0.30%) |
| Clindamycin | J01FF01 | 29(1.49%) |
| Colistin | J01XB01 | 2(0.1%) |
| Cotrimoxazole | J01EE01 | 2(0.1%) |
| Doxycycline | J01AA02 | 3(0.21%) |
| Faropenem | J01DI03 | 3(0.21%) |
| Fosomycin | J01XX01 | 1(0.05%) |
| Gentamicin | J01GB04 | 3(0.21%) |
| Imipenem | J01DH51 | 1(0.05%) |
| Levofloxacin | J01MA12 | 35(1.8%) |
| Linezolid | J01XX08 | 19(0.98%) |
| Meropenem | J01DH02 | 170(8.77%) |
| Metronidazole | J01XD01 | 258(13.3%) |
| Moxifloxacin | J01MA14 | 2(0.1%) |
| Neomycin | J01GB05 | 1(0.05%) |
| Netilmicin | J01GB07 | 1(0.05%) |
| Nitrofurantoin | J01XE01 | 3 (0.15%) |
| Ofloxacin | J01MA01 | 25(1.29%) |
| Piperacillin and Tazobactum | J01CR05 | 238(12.2%) |
| Polymixin-E | J01XB02 | 1(0.05%) |
| Rifaximin | A07AA11 | 17(0.88%) |
| Streptomycin | A07AA04 | 4(0.20%) |
| Tiecoplanin | J01XA02 | 9(0.46%) |
| Tigecycline | J01AA12 | 7(0.36%) |
| Vancomycin | A07AA09 | 36 (1.85%) |

**Table 4: No. of patients on definitive therapy, double anaerobic cover and double cover for g-negative organisms**

| Wards | Patients with definitive therapy % | Double anaerobic cover % | Double cover for Gram-negative % |
|---|---|---|---|
| Medicine (N=445) | 3 (0.67) | 17 (3.82) | 64 (14.38) |
| Surgery (N=345) | 2 (0.57) | 41 (11.88) | 48 (13.91) |
| Obstetrics and Gynaecology (N= 216) | 3 (1.38) | 11 (5.09) | 108 (50) |
| Paediatrics (N=118) | 11 (9.32) | 9 (7.62) | 33 (27.96) |
| ICUs (N=175) | 2 (1.14) | 35 (20) | 66 (37.71) |
| Others (ENT and Orthopaedics) (N=97) | 0 | 3 (3.09) | 30 (30.92) |
| Total (N=1396) | 21 (1.50) | 116 (8.30) | 349 (25) |

The proportion of antibiotics used as categorized by the WHO AWaRe (Access, Watch and Reserve) list is shown in fig. 1. Out of 1937 prescribed antibiotics, 557 belonged to the Access group, 1347 belonged to the Watch group, and 33 belonged to the Reserve group. Out of the total prescriptions 154 antibiotic prescriptions were in the 'Not Recommended category'.

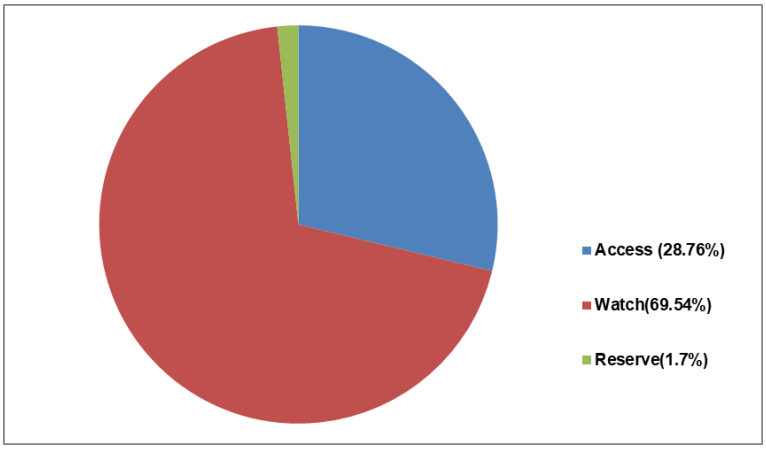


**Fig. 1: Distribution of AWaRe category antibiotics**

Fig. 2 explains the top three antibiotics used in various wards. Overall, Ceftriaxone was the most commonly used individual antibiotic in medicine, surgery and obstetrics and gynaecology, paediatrics and other ward. But amikacin was the mostly used antibiotic in the ICUs. Parenteral route 1796 (92.72%) of administration was most common. Stop/review date was documented for 235 (12.13%) prescriptions.

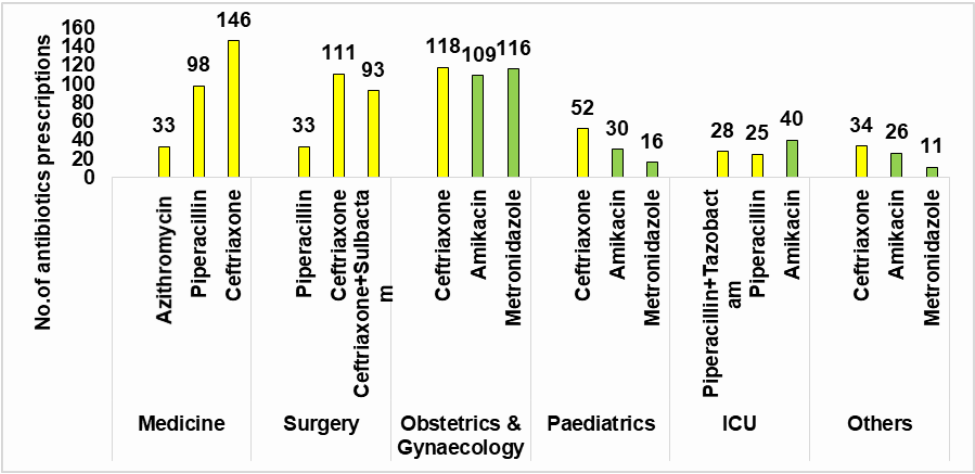


**Fig. 2: Graphical representation of various antibiotics used in different wards**

## DISCUSSION

Effective surveillance of antibiotic use is essential to rationalize antibiotic prescriptions and controlling the emergence of multidrug-resistant microbes. Antibiotic surveillance is of paramount importance for identifying targets for quality improvement and informing policymakers to formulate and implement effective antibiotic stewardship policies. As more irrational antibiotic use has been observed during the COVID-19 pandemic, it makes on-going surveillance of antibiotic prescriptions very crucial [14]. India is one of the largest consumers of antibiotics globally. Poor prescription quality and un-indicated prescription of broad-spectrum antibiotics without evidence of bacterial infection are of particular public health relevance, considering the fact that India reports on high antibiotic resistance in bacteria that cause certain common infections [15]. Antimicrobial resistance not only increases morbidity and mortality due to infections but also increases financial burden to the family and community at large [16]. To our knowledge, and based on a search of the literature at the time of writing, our study represents the first published survey of the point prevalence of antimicrobial consumption performed in a tertiary care hospital in Assam. A majority of the prescribed antimicrobials were administered via the parenteral route. A third generation Cephalosporin, Ceftriaxone was the most commonly prescribed antibiotic which accounted for more than one-third of all antibiotics prescribed. A stop or review date recorded in less than one-quarter of the patient medical notes. Local antimicrobial treatment guidelines were not available for antimicrobial prescriptions during the study period. Our study revealed a prevalence of antibiotic consumption (79.44%), which was higher than the national prevalence observed in a multicentre point prevalence survey (PPS) in India (50.3%) and Myanmar (64.4%) [17, 9]. The prevalence of antibiotic use was proportional to the findings of Nigeria (81%) and Pakistan (77.6%) [18, 19].

As per WHO recommendations, approximately 60% of the antibiotics should be from the "Access category" with a negligible amount of usage of the Reserve group of antibiotics [20]. In our study, the ground reality was a bit alarming. In our study, only 28.76% of the mean antibiotic usages were from the "Access category". The "Watch category" of drugs was used in 69.54%. The "Reserve category" that should be as minimally used as possible was found to be up to 1.7%.

The highest prevalence of antibiotic use was for surgical prophylaxis (30.66%), which is comparable to the findings of a multicentric PPS of antibiotic use in India through Global PPS in 2019 [21]. Of concern, the majority of patients (85.29%) receiving surgical prophylaxis were treated for more than one day. Only 1.18% received the single dose of surgical prophylaxis that is recommended in international guidelines for most surgical procedures. As prolonged prophylaxis increases the risks of antimicrobial resistance and side effects, this is, therefore, a crucial

quality indicator that needs to be harnessed to combat the threat of antibiotic resistance in the institution [22, 23]. Beta-lactam antibiotics [Cephalosporins (39.39%) and Penicillins (13.94%)] were the most frequently used antibacterial in our study, followed by Nitroimidazole (13.32%) and Aminoglycosides (12.18%). The pattern found in antibiotic use here is largely consistent with the recently published point prevalence survey of antibiotics in Thailand and Mauritius [24, 25]. However, the usefulness of beta lactam antibiotics in the coming days is threatened, as data show that antimicrobial resistance is associated with increased use of antibiotics [26].

## CONCLUSION

The results of the study indicate that there is a wider scope for improvements towards the development and implementation of Antibiotic Stewardship strategies by the institution. Some identified areas to improve the current scenario of antimicrobial consumption were: formulation of hospital antibiotic policy and following proper medical and surgical prophylaxis guidelines, decreasing use of antibiotic combinations and double anaerobic cover, training resident doctors and nursing staff to categorize antibiotic prescriptions appropriately and ensuring effective communication among health care workers by documenting adequate information in medical notes.

## LIMITATIONS

The seasonal nature of some diseases that require the use of antibiotics may also influence the prevalence fig. as data collection happened over a point of time. The type of antibiotic consumption may also be affected by the availability of the type of antibiotics from the ELM at that particular point of time. Therefore, continuous PPS at different times of the year is needed to predict the actual antimicrobial prevalence in the hospital.

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## CONFLICT OF INTERESTS

Declared none

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